

may be seen the "pit-head frame," with the winding pulleys, which was erected by the students.

THE Technical Education Board of the London County Council is offering facilities for boys who are leaving, or have recently left, public elementary schools to enter upon a course of training which will fit them to become gardeners. A school of practical gardening has been established at the Royal Botanic Society, Regent's Park, and is now attended by some thirty boys, most of whom are holding scholarships from the Technical Education Board. The boys at this school go through a three-years' course, in which they have a thorough training in practical gardening and also receive instruction in elementary science and botany. The scholarships offered by the Board are open to boys between the ages of fourteen and sixteen, whose parents are resident within the County of London and are in receipt of incomes not exceeding 250*l.* a year. The scholarships provide free tuition for three years at the School of Practical Gardening, and also a maintenance grant rising from 20*l.* a year to 25*l.* a year. There is no examination for these scholarships, but parents are required to sign a declaration to the effect that they intend their sons to become practical gardeners. Full particulars of these scholarships, together with application forms, may be obtained from the secretary of the Technical Education Board, 116 St. Martin's Lane, W.C. Application should be made not later than Monday, July 15.

SCIENTIFIC SERIAL.

Annalen der Physik, June.—On the parameters in the physics of crystals and on directed magnitudes of higher order, by W. Voigt.—On the change of the conductivity of salt solutions in liquid sulphur dioxide with temperature up to the critical point. Electrolytic conductivity in gases and vapours. The absorption spectra of solutions with iodine salts, by A. Hagenbach. Various alkaline salts, chiefly iodides, were dissolved in dry liquid sulphur dioxide and the conductivities measured at temperatures up to and just above the critical point. These salt solutions behave as electrolytes, even up to the critical point. The fact that polarisation occurs, shows that the electricity is conducted in the solution by means of ions. The temperature coefficients are negative between the limits of the experiments (from 20° to 160° C.), with the exception of potassium iodide, which shows a maximum of conductivity at about 90°. In the conductivity curves the critical temperature is clearly shown, although there is no absolute discontinuity at this point. Some interesting observations were made on the state of the dissolved solid when the liquid was just above the critical point, as after the meniscus had vanished the resistance of the vapour differed according as the electrodes were in the upper or lower portion of the tube, this difference disappearing immediately on shaking the tube.—On the second law of thermodynamics, by N. Schiller.—The thermodynamics of saturated solutions, by N. Schiller.—On an improved method for the preparation of photographic plates sensitive to the ultra-violet rays, by V. Schumann. A detailed description of the methods of preparing the emulsion, coating and drying the plates, exposure and development. An example is given showing the increased length of spectrum obtained with these plates as compared with an ordinary dry plate.—On a mechanical representation of the electrical and magnetic phenomena in bodies at rest, by L. Graetz.—On changes of weight during chemical and physical changes, by A. Heydweiller. Various chemical reactions were carried out in closed vessels, and in certain cases slight changes in weight were observed which, in the opinion of the author, were outside the range of possible experimental error.—Researches on electrical discharge in rarefied gases, by W. Wien.—Experiments on the influence of capillarity on the velocity of outflow of liquids, by C. Christiansen.—Communication to the knowledge of the physical properties of silver mirrors, by C. Grimm. A study of the electrical resistance of thin silver mirrors under varying conditions of temperature, light, degree of polish, &c.—On a new experiment in dynamics, by V. v. Niesiolowski-Gawin.—On the behaviour of liquid dielectrics on the passage of an electric current, by E. v. Schweidler.—Stroboscopic methods for the determination of the frequency of alternation and lag of a motor, by G. Benischke.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 6.—"On the Elastic Equilibrium of Circular Cylinders under Certain Practical Systems of Load." By L. N. G. Filon, M.A., B.Sc., Research Student of King's College, Cambridge; Fellow of University College, London; 1851 Exhibition Science Research Scholar. Communicated by Prof. Ewing, F.R.S.

The paper applies the equations of elasticity to the investigation of problems connected with the circular cylinder. The solutions are symmetrical about the axis of the cylinder, and are obtained as infinite series involving circular and Bessel's functions.

The three problems treated of are as follows:—

In the first a cylinder under pull is considered, the pull not being applied by a uniform distribution of tension across the plane ends, but by a given distribution of axial shear over two zones or rings towards the ends of the cylinder.

This corresponds to conditions which frequently occur in tensile tests, namely, when the piece is gripped by means of projecting collars, the pull being in this case transmitted from the collar to the body of the cylinder by a system of axial shears.

It is found that the stress is greatest at the points where the shear is discontinuous, *i.e.* at the ends of the collar in a practical case. At these points it is theoretically infinite. For a short cylinder the tensile stress varies a great deal over the cross-section and the distortion of the latter is large.

The second problem is that of a short cylinder compressed longitudinally between two rough rigid planes, in such a manner that the ends are not allowed to expand. It illustrates the crushing of blocks of cement or stone between iron planes or sheets of millboard.

The greatest stress occurs at the perimeter of the plane ends and the "strength" is less than two-thirds of the strength under uniform compression. This result apparently contradicts the fact that the strength of stone or cement, when tested between lead plates, which allow of expansion, is very much less than when tested between millboards; but if we take into account the consideration suggested by Unwin ("Testing of Materials of Construction," p. 419) and corroborated by Prof. Ewing, that lead, which flows easily, may not merely allow, but *force* the expansion of the ends of the block, then it is shown that in tests between lead plates the strength may be much less than between millboards; moreover, such tests are indeterminate. The millboard test should give consistent results, though really introducing too large a factor of safety. The change in the form of the fracture noticed by Unwin is also confirmed by theory.

The third problem is that of the torsion of a bar in which the stress is applied, not by cross-radial shears over the flat ends, as the ordinary theory of torsion assumes, but by transverse shears over the curved surface. This corresponds to the case of a shaft or axle twisted by a frictional couple.

It is shown that the points of danger are those where the applied shear changes discontinuously. At a distance from these the solution rapidly degenerates into the ordinary type.

Physical Society, June 28.—Prof. Everett, F.R.S., vice-president, in the chair.—A paper on the effect of a high frequency oscillatory field on electrical resistance was read by Mr. S. A. F. White. The object of this paper is to discover if the action of light upon the electrical resistance of selenium can be imitated by using high frequency electrical oscillations. It is found that such oscillations permanently increase the resistance of selenium. The effect of a rise of temperature is to increase the resistance of a piece of low resistance and decrease the resistance of a piece of high resistance. The effects of the field in a piece of high resistance can be reversed by exposure to light or by reheating and subsequent cooling. In the case of tellurium a high frequency field temporarily decreases the resistance, as also does a rise in temperature. Repeated heating and cooling of a piece of tellurium permanently increases its resistance. It seems probable that all of the effects are due to rise of temperature caused by minute sparks within the mass. The rise in resistance by alternate heating and cooling may be due to the formation of tellurides with the metal of the electrodes. The large negative temperature effect of tellurium suggests that it might be usefully employed in the detection of heat radiation. The chairman expressed his interest in the paper and drew attention

to the very rapid action of light upon selenium. Prof. Adams said that as the effects here noticed were not so rapid as in the case of light they were probably due to change in temperature. Prof. Bose said he had tried the effect of Hertzian radiation upon thin layers of various metals and found an increase of resistance in the case of selenium and decrease in the case of tellurium. The effect of radiation is confined to a few layers on the surface of the conductor, but it appears that it is of the same nature in continuous solids as in coherers.—A paper by Mr. E. C. C. Baly and Dr. H. W. Syers on the spectrum of cyanogen was read by Mr. Baly. The authors have been able to obtain the spectrum of cyanogen by allowing the pure gas to flow through a vacuum tube and observing from the end of the tube. This is necessary on account of the brown deposit of paracyanogen, which renders observation in the ordinary way impossible. The spectrum obtained differs from the flame spectrum, and consists of a series of equidistant flatings through the whole of the red and yellow somewhat recalling those of the positive band spectrum of nitrogen. The experiments prove that (1) the swan spectrum is not produced by a carbon compound which does not contain oxygen; (2) the swan spectrum is that of an oxide of carbon, as it is only produced by carbon monoxide; and as this spectrum is changed at once into the carbon oxide spectrum by admission of oxygen or by intense electric discharge, and, further, as the carbon oxide spectrum is invariably given by carbon dioxide, there can be no doubt that (3) the swan spectrum is that of carbon monoxide and the carbon oxide spectrum that of carbon dioxide. Mr. Gaster said that this paper might throw light on the discussion of the arc where cyanogen, carbon monoxide and carbon dioxide are present. The presence of cyanogen might be able to explain the hissing of the arc.—The Society then adjourned until next October.

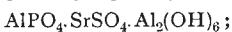
Royal Astronomical Society, June 14.—Mr. E. B. Knobel, vice-president, in the chair.—The secretary read the observations of the great comet of 1901, made at the Royal Observatory, Cape of Good Hope. The comet was first seen on April 24 by Mr. Hills, of Queenstown, Cape Colony, and rapidly became a very brilliant object, with two tails, one conspicuously brighter than the other; the fainter tail was, however, considerably the longer. Photographs taken at the Cape Observatory with a portrait lens and with the McClean 24-inch telescope were shown, and also a drawing made by Mr. Lunt, of the same observatory, which showed several smaller tails between the two main ones. The elements computed gave a parabolic orbit. Mr. Nevill, of the Durban Observatory, who was present at the meeting, said he had received a letter from which it appeared that the comet was seen in Natal the day before it was first detected in Cape Colony.—Prof. Turner gave an account of a paper by Dr. Gill on the Oxford photographic determinations of stellar parallax, and of his own reply. In the discussion which ensued the Astronomer Royal and others called attention to the various irregularities to which stellar photographs are liable.—Lord Rosse read an account of observations of Nova Persei made at the Birr Castle Observatory; further observations by Dr. Rambaut and Mr. Stanley Williams were also read. It appeared that periodical fluctuations in the light of the star (from about magnitude $4\frac{1}{2}$ to 6) still occur, though there no longer seems to be any progressive decrease in its light.—Mr. J. C. W. Herschel read his observations made at Cambridge of the Lyrid meteors.—Mr. Horner read his spectroscopic observations of the sun, made in England about the time of the total eclipse that was visible in Sumatra. He recorded an observation of a most unusually rapid disappearance of a bright solar prominence.—A paper from Prof. D. P. Todd was read, describing a mechanical device for giving graduated exposures in photographing the corona. The method was a modification of that of Mr. Burckhalter, obviating the necessity of using perforated plates.—A paper, by Dr. A. W. Roberts, on the light variations of R. Carinæ, called attention to long and short period variations of a very interesting character.

Zoological Society, June 18.—Prof. G. B. Howes, F.R.S., vice-president, in the chair.—A communication was read from Prof. Ray Lankester, F.R.S., on the new African mammal lately discovered by Sir Harry Johnston in the forest on the borders of the Congo Free State, of which two skulls and a skin were exhibited. Prof. Lankester fully agreed with Sir Harry as to this mammal belonging to a quite new and most remarkable form allied to the giraffes, but having some relation to the

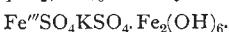
extinct Helladotherium, and proposed for it the generic name Okapia, from its native name "Okapi." The scientific name of this mammal would therefore be *Okapia johnstoni*, Mr. Sclater having already given it a specific name based on the pieces of its skin previously received. Sir Harry Johnston, who was himself present, gave an account of the facts connected with his discovery of this animal. Sir Harry also stated that during his last excursion to the north of Mount Elgon he had found large herds of a giraffe in this country which appeared to be distinct from previously known forms of this mammal in having five bony protuberances on the head, four placed in pairs and one anterior in the middle line. Four examples of this animal were now on their way home, and would soon be here to settle the validity of this presumed new species.—The Hon. W. Rothschild, M.P., exhibited and made remarks upon specimens of a mounted male and two unmounted males and a female of the rare Abyssinian goat (*Capra walie*, Rüppell), and of a mounted male of the Abyssinian wolf (*Canis simensis*, Rüppell), which had been obtained by Captain Powell-Cotton during his recent visit to Abyssinia.—Mr. Oldfield Thomas exhibited a pair of antlers which had been sent home by Mr. Charles Hose, who had obtained them from Central Borneo. They appeared to differ from the antlers of all other known deer in being highly complicated and many-branched, with the upper portion curved forward, and the brow-tines developed into broad horizontal paddle-like structures. From this character it was proposed to term the species *Cervus spatulatus*.—Mr. R. Shelford exhibited a series of lantern slides, exemplifying mimicry amongst Bornean insects, especially amongst the Longicorn division of the Coleoptera.—A communication was read from Mr. J. E. S. Moore containing an account of his recent researches on the mollusca of the great African Lakes.—A communication from Captain H. N. Dunn contained field notes on eight species of antelopes, specimens of which he had met with during his recent sojourn on the White Nile in connection with the "Sudd" expedition.—A communication was read from Dr. R. Bowdler Sharpe on the birds collected by Dr. Donaldson Smith during the early part of 1889 in Northern Somaliland. Specimens of 103 species were contained in the collection.—A communication from M. Constantin Saturnin contained a description of a new species of hedgehog from Transcaucasia, proposed to be named *Erinaceus calligoni*. To this was added a revision of the species of the genus *Erinaceus* of the Russian Empire.—A communication was also read from Mr. J. Lewis Bonhote on the evolution of pattern on birds' feathers, in which it was attempted to show how all the various patterns on the feathers had been derived from a common origin, and were passing or had passed through a definite series of stages before reaching the shapes in which they were found.—Mr. J. Cosmo Melville read the first part of a paper prepared by himself and Mr. Robert Standen, entitled "The Mollusca of the Persian Gulf, the Gulf of Oman and the Arabian Sea, as evidenced mainly through the collections made by Mr. F. W. Townsend, of the Indo-European Telegraph Service, 1893-1900." The area embraced was determined by an imaginary line (for which reasons were given) drawn obliquely from Cape Ras El Had, below Maskat (lat. $22^{\circ} 50' N.$), and Panjin, India (lat. 16°). This was the first attempt towards a complete catalogue of the mollusca of this region, between 900 and 1000 species being named, of which more than one-third were of very restricted distribution.

Mineralogical Society, June 18.—Dr. Hugo Müller, vice-president, in the chair.—Mr. Alfred Harker gave a simple proof of the anharmonic ratio of four faces in a zone.—Mr. William Barlow, in continuation of his work on the partitioning of space on the principles of closest packing, exhibited models which presented accurately the symmetry displayed by potassium-alum. The symmetry of various tetrahedral minerals was also explained by the twist which must be given to certain groups of atoms in order to make the packing as close as possible.—Mr. Herbert Smith, in continuation of an examination of crystals of calaverite, showed by means of a gnomonic projection the extremely intricate character of the crystals. The general form suggests monoclinic symmetry, and a well developed face perpendicular to the prism edge frequently occurs; but the symbols which on this supposition must be assigned to the faces are, with few exceptions, very complicated. The majority of the faces lie on a lattice with triclinic symmetry, and of the remainder the majority lie on another lattice inconsistent with the former.—Mr. G. T. Prior pointed out the isomorphous relations between sulphates and orthophosphates as exhibited

in a group of rhombohedral minerals, including hamlinite, $\text{AlPO}_4 \cdot \text{SrHPO}_4 \cdot \text{Al}_2(\text{OH})_6$; florencite, $\text{AlPO}_4 \cdot \text{CePO}_4 \cdot \text{Al}_2(\text{OH})_6$; beudantite, $\text{Fe}''\text{PO}_4 \cdot \text{PbSO}_4 \cdot \text{Fe}_2(\text{OH})_6$; svanbergite,



alunite, $\text{AlSO}_4 \cdot \text{KSO}_4 \cdot \text{Al}_2(\text{OH})_6$; and jarosite,



Similar relations are also shown by the isomorphous pairs, monazite, CePO_4 ; and crocoite, PbCrO_4 ; fergusonite, YNbO_4 ; and scheelite, CaWO_4 ; herderite, CaFBePO_4 , and caracolite, $\text{NaCl} \cdot \text{PbSO}_4$ (?); pharmacolite, $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$, and gypsum, $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$.

PARIS.

Academy of Sciences, June 24.—M. Fouqué in the chair.—Chemical equilibria. Reactions of two bases added simultaneously to phosphoric acid, by M. Berthelot. The author has studied the distribution of the bases between the precipitate and solution obtained when sodium hydroxide and calcium (or barium) hydroxide are added to a solution of phosphoric acid. A considerable proportion of the sodium is in every case found to be contained in the precipitate.—On acetylometallic radicles, by M. Berthelot. The composition of the metallic derivatives of acetylene recently described by M. Chavastelon is shown to be capable of being represented in accordance with the views formerly expressed by the author as to the presence of acetylometallic radicles in such compounds.—Synthesis of a colouring matter derived from diphenylenephethylmethane, by MM. A. Haller and A. Guyot. Crystal violet is converted by a series of reactions into the leucobase hexamethyltriamidophenylfluorene which, when oxidised with lead peroxide, yields fluorene blue, $\text{C}_{25}\text{H}_{28}\text{N}_3\text{Cl} + 2\frac{1}{2}\text{H}_2\text{O}$. This colouring matter has a bluer tint than crystal violet, but does not differ essentially from the latter as regards its tintorial properties.—A simple and trustworthy apparatus, capable of easy and rapid application, for facilitating existence and work in irrespirable atmospheres contaminated with deleterious gases, by MM. A. Chauveau and J. Tissot. The essential feature of the apparatus is an arrangement for the separation of the currents of inspired and expired air.—On globular lightning, by M. J. Viole. An instance of globular lightning was observed towards the end of a storm on June 9 last.—Action of an oxide or a metallic hydroxide on solutions of the salts of other metals: mixed basic salts, by M. Paul Sabatier. Observations on a recent paper by M. Recoura.—Third series of observations of the new star in Perseus, by M. H. Deslandres (see p. 240).—On the continuous deformation of surfaces, by M. D. Th. Egorov. Remarks on a recent communication by M. Tzitzica. Theory of linear groups in an arbitrary region of rationality, by M. L. E. Dickson.—On the integration of the equation $\Delta w - \mu^2 w = 0$, by M. S. Zaremba.—Chemical reactions in dissolved or gaseous systems. Vapour tension; Avogadro's hypothesis, by M. Ponson. A continuation of previous papers on the subject, which is treated mathematically.—Capillary constants of organic liquids, by MM. Ph. A. Guye and A. Baud. The results described show that oximes and urethanes resemble alcohols, acids, ketones, &c., in being polymerised in the liquid state. The group of urethanes is remarkable in that the degree of polymerisation increases with the molecular weight.—On the preparation of phosphorous oxide, by M. A. Besson. Fresh experiments are cited in proof of the existence of the oxide P_2O_5 , previously described by the author.—On the action of solar radiations on silver chloride in presence of hydrogen, by M. Jouniaux. When sealed tubes containing silver chloride and hydrogen are exposed to sunlight, metallic silver is formed, and, under favourable conditions, the whole of the hydrogen is eventually converted into hydrogen chloride.—Action of mercuric oxide on aqueous solutions of metallic salts, by M. A. Mailhe. The action of freshly precipitated mercuric oxide on the chlorides, nitrates and sulphates of manganese, cadmium, lead and iron is described. With sulphates no reaction occurs, as a rule, but the chlorides and nitrates are decomposed with the formation of mixed basic salts.—Observations on basic salts containing several metallic oxides, by M. G. André. A number of complex salts were described by the author some years before the recent experiments of MM. Mailhe and Recoura.—Action of bases and acids on the salts of amines, by M. Albert Colson. Former experiments on this subject are continued.—On racemic erythritol, by MM. L. Maquenne and Gab. Bertrand. Griner's experiments are confirmed and extended. The four

theoretically possible stereoisomeric erythritols are now known.—Action of acid chlorides on aldehydes in presence of zinc chloride, by M. Marcel Descudé. The action of acid chlorides on aldehydes is greatly facilitated by the presence of a trace of zinc chloride.—Nitration of acetylacetic ethers and their acid derivatives, by MM. L. Bouveault and A. Bongert.—On the acidometric value of parasulphanilic acid, by M. G. Massol. A thermochemical paper.—On racemism, by MM. J. Minguin and E. Gregoire de Bollemon. The properties of a number of racemic camphor derivatives are compared with those of their active constituents.—Synthesis of boronatrococalcite (ulexite), by M. A. de Schulten. The artificial mineral may be obtained by adding calcium chloride to a large excess of cold, saturated borax solution, and leaving the mixture at rest for fifteen to thirty days.—On the commencement of germination and the evolution of sulphur and phosphorus during this period, by M. G. André.—Morphology of the digestive apparatus of *Dytiscus*, by M. L. Bordas.—On the sensibility of higher plants to the useful action of potassium salts, by M. Henri Coupin. The growth of wheat is shown to be favoured by almost infinitesimal quantities of potassium salts.—On the constitution of the seed of *Hernandia* compared with that of *Ravensara*, by M. Édouard Heckel.—Use of the Oudin resonator for the production of X-rays, by M. R. Demerliac.—On the presence and localisation of iodine in the leucocytes of normal blood, by MM. Stassano and P. Bourcet. The small quantity of iodine contained in normal blood exists exclusively in the leucocytes.—On the production of local anaesthesia in dental surgery by means of currents of high frequency and intensity, by MM. L. R. Regnier and G. Didsbury.—On the conservation of mineral waters, by M. F. Parmentier.

CONTENTS.

PAGE

Scientific Worthies. XXXIII. Sir William Huggins, K.C.B. By Prof. H. Kayser. (With Portrait.)	225
England's Neglect of Science. By Prof. George M. Minchin, F.R.S.	226
Grant Duff's Notes from a Diary. By Lord Avebury, F.R.S.	228
Field Experiments on Wheat. By N. H. J. M.	229
Earth Current Measurements	230
Our Book Shelf:—	
Maeterlinck: "The Life of the Bee."—W. F. K.	231
Kingsley: "West African Studies"	231
Sidgwick: "The Use of Words in Reasoning"	231
"Holidays in Eastern Counties"	232
Letters to the Editor:—	
A Vertical Light-beam through the Setting Sun.—Prof. A. S. Herschel, F.R.S.	232
A New Method of using Tuning-forks in Chronographic Measurements.—Rev. F. J. Jervis-Smith, F.R.S.	232
Long-tailed Japanese Fowls.—Frank Finn	232
Decomposition of Copper Oxide.—Philip Harrison	233
The Subjective Lowering of Pitch.—E. C. Sherwood	233
A Curious Phenomenon.—Stanley B. Hutt	233
The Antarctic Expedition	233
The Simplon Tunnel. (Illustrated.)	235
Notes	236
Our Astronomical Column:—	
Spectrum of Nova Persei	240
Dark Spot on Jupiter	240
The Meteoric Epoch of July and August. By W. F. Denning	240
The "Edison" Storage Cell. (Illustrated.)	241
The Biology of Mount Shasta	242
The Nadir of Temperature and Allied Problems. By Prof. James Dewar, F.R.S.	243
University and Educational Intelligence. (Illustrated.)	244
Scientific Serial	246
Societies and Academies	246